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The primary purpose of this project is to determine the durability of the 1965 Tentative Specification paving asphalt in terms of service life. It will take a period of time to draw any positive conclusions concerning the asphalt.

We have observed from preliminary tests involving both the new and control asphalts, that the new product should prove more durable. There were no difficulties encountered during either the placement of the asphalt mixture or during the preliminary tests.

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HIGHWAY RESEARCH REPORT

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EXPERIMENTAL ASPHALT TEST SECTION ROAD 03-YUB-70-0.1/R8.9

STATE OF CALIFORNIA

TRANSPORTATION AGENCY

DEPARTMENT OF PUBLIC WORKS

DIVISION OF HIGHWAYS

MATERIALS AND RESEARCH DEPARTMENT

RESEARCH REPORT

NO. M & R 633134

Prepared in Cooperation with the U.S. Department of Transportation, Bureau of Public Roads March, 1968

STATE OF CALIFORNIA—TRANSPORTATION AGENCY RONALD REAGAN, Governor

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
MATERIALS AND RESEARCH DEPARTMENT
5900 FOLSOM BLVD., SACRAMENTO 95819

March, 1968

Interim Report
M&R No. 633134

Mr. J. A. Legarra
State Highway Engineer

Dear Sir:

Submitted herewith is a research report titled:

EXPERIMENTAL ASPHALT TEST SECTION

ROAD 03-YUB-70-0.1/R8.9

Ernest Zube

Principal Investigator

John B. Skog and Glenn R. Kemp

Co-Investigators

Assisted by

Gene S. Stucky

Very truly yours,

JOHN L. BEATON
Materials and Research Engineer

REFERENCE: Zube, E.; Skog, J. B., and Kemp, G. R., "Experimental Asphalt Test Section Road 03-Yub-70-0.1/R8.9", State of California, Department of Public Works, Division of Highways, Materials and Research Department, Research Report 633134, March, 1968.

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We have observed from preliminary tests involving both the new and control asphalts, that the new product should prove more durable. There were no difficulties encountered during either the placement of the asphalt mixture or during the preliminary tests.

KEY WORDS: Testing, asphalts, asphalt pavements, durability, laboratory studies, field performance, field tests, test sections, construction methods, pavements, asphalt tests, tentative specification, experimental asphalt.

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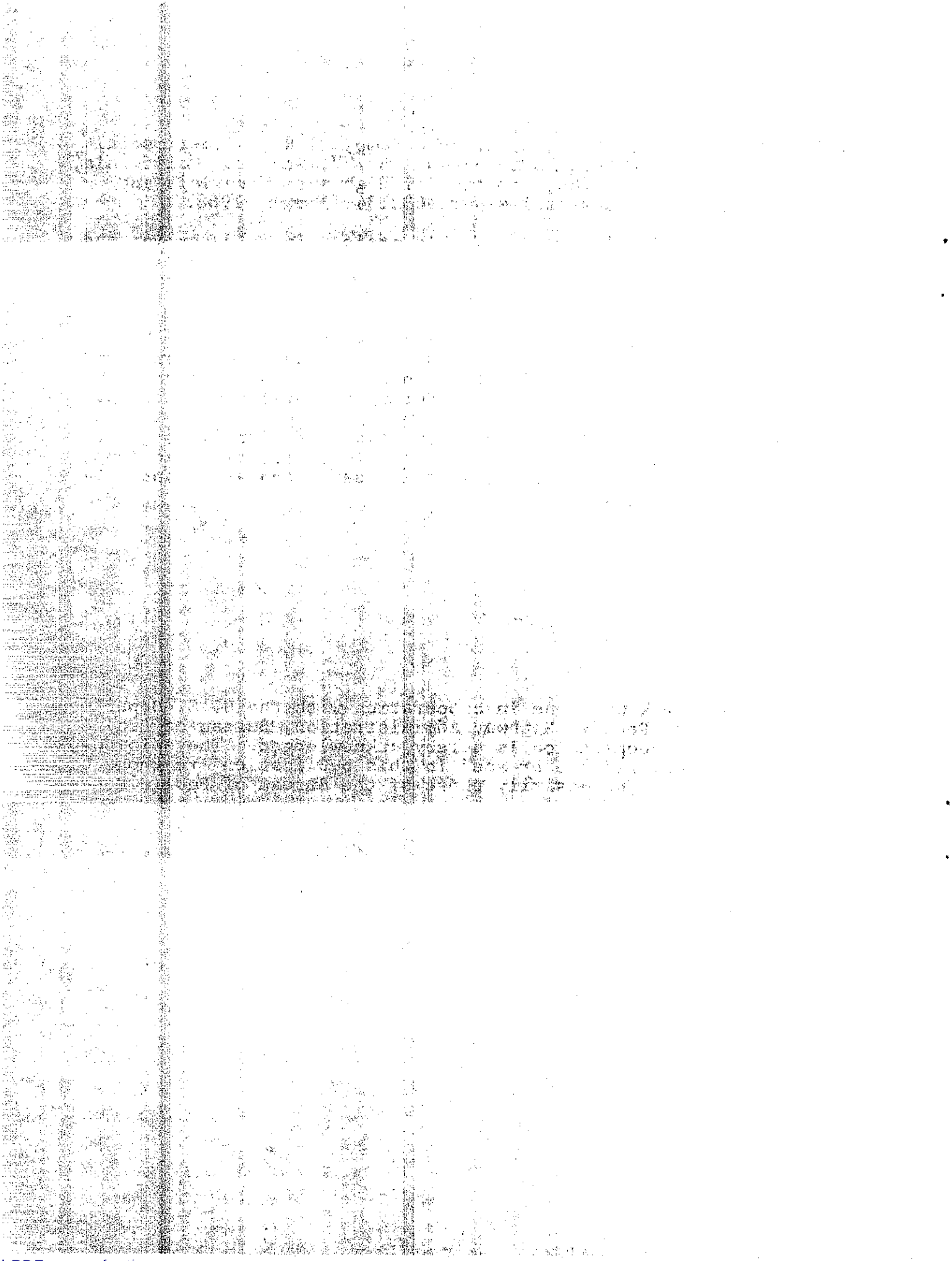

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INTRODUCTION

The purpose of this project was to incorporate approximately seventy-nine tons of the new 1965 Tentative Specification paving asphalt into the paving mixture used on Contract 03-020964, Road 03-Yub-70-0.1/R8.9. The Shell Oil Company produced fifty tons of the material and the Union Oil Company produced approximately twenty-nine tons of the material. The fifty tons produced by Shell Oil Company permitted the paving of 6,480 feet of the two inch thick surface course in the southbound travel lane between Stations 232+50 and 297+30. The twenty-nine tons produced by Union Oil Company permitted the paving of 3,720 feet of the two inch thick surface course in the southbound travel lane between Stations 297+30 and 334+50. A control section for comparison of rolling and "setting" properties and for future coring was established in the northbound travel lane between Stations 255+00 and 265+00. The control section contained the contract asphalt which was Standard Specification 85-100 grade produced by Shell Oil Company.

All three asphalt sections were laid by Standard Specification procedures and no rolling difficulties were encountered. The "setting" quality of paving mixtures prepared from the various asphalts was satisfactory.

The test sections as placed should provide valuable future information on the weathering rates of the experimental and control asphalts since the durability test indicates differences for this property.

The purpose of this report is to present observations and field test results during construction of the test sections, together with laboratory studies on the original asphalts, field mix samples, and cores removed from the pavement shortly after construction.

CONCLUSIONS

The 1965 Tentative Specification experimental asphalts provided paving mixtures on this project which were satisfactory in every respect and had good "setting" and rolling characteristics. Evaluation of the durability aspects of these asphalts in relation to field performance will follow at a later date.

CONSTRUCTION OF TEST SECTIONS

Asphalt concrete paving on this project consisted of 0.33' Type "B" Asphalt Concrete. The experimental Shell asphalt was used in the 0.17' Type "B" AC surface course of the southbound travel

lane between Stations 232+50 and 297+30. The experimental Union asphalt was used in the 0.17' Type "B" AC surface course of the southbound travel lane between Stations 297+30 and 334+50. The intended asphalt content of the mix was 5.4%, the same as used for the rest of the contract.

In order to compare the rolling and "setting" properties of the experimental asphalt, a control section was established in the northbound travel lane between Stations 255+00 and 265+00. The control section contains the contract asphalt which is Standard Specification 85-100 grade asphalt from Shell Oil Company.

Paving operations using the experimental and control asphalts were performed on September 12 and 13, 1967. Weather conditions were very good with clear and warm days.

The paving mixtures were produced in dual mix plants, a 3000 pound Madsen batch plant and a 4000 pound Standard batch plant located approximately 15 miles from the job-site. The mix temperatures recorded on page 4 were obtained on the street. Arrangements were made at the plants to use a spare paving asphalt tank to handle the experimental asphalts thereby reducing contamination and paving operation delays.

The mixtures were placed on the roadbed with bottom-dump trucks and spread with a Barber Greene paver. The rolling on the project was accomplished with a 12 ton steel wheel roller for breakdown, a pneumatic with tire pressure of 90 psi for intermediate rolling, and a 12 ton steel wheel roller for finish operations. Rolling procedures were normal with the required number of passes except for a portion of the experimental Union which was not pneumatically rolled because the roller broke down. Average rolling temperatures were as follows:

Asphalt Test Section	Breakdown	Pneumatic
Experimental Shell Asphalt	235°F	145°F
Experimental Union Asphalt	250°F	155°F
Control 85-100 Grade Asphalt	240°F	150°F

The breakdown roller followed directly behind the paver. The pneumatic rolling was performed as soon after breakdown rolling as possible without picking up the hot mix. The pneumatic roller broke down after rolling approximately 1000 feet of the Special Union section and the remainder (Sta. 307+30 - 334+50) of that section did not receive any pneumatic rolling. A different pneumatic roller was used on the control section.

	Specification Requirement	Experimental Shell Asphalt	Experimental Union Asphalt	Shell 85-100 Grade Control Asphalt
Flash Point, P.M.C.T. ^{o}F Min.	450	460	455	440
Penetration of Original Sample at 77^{o}F		68	78	88
Stain Number of Original Sample. Maximum after 120 hrs, -140^{o}F-50 psi Pressure	10	5	6	
Rolling Thin Film Test at 325^{o}F-75 Min.				
Viscosity of Residue 140^{o}F Poises	4000 - 6000	4316.4	4486.7	4602.5
Viscosity of Residue 275^{o}F Centistokes	425 - 800	465	531	537
Ductility of Residue 77^{o}F, Min.	75cm	100+cm	100+cm	100+cm
Durability Test				
Viscosity of Residue after durability test, megapoises at 77^{o}F				
Shear Rate 0.05 sec^{-1} Max.	25	33.8*	23.8	34.2
Shear Rate 0.001 sec^{-1} Max.	60	78.0*	55.0	130.0
Micro-Ductility of residue 1/2 cm/min Minimum, mm	10	9*	7*	2
Shear Susceptibility		.22	.22	.34
Solubility, CCl_4, Orig. Sample Minimum	99	99.94	99.93	99.94

*Did not meet specification requirements.

The finish roller followed directly behind the pneumatic and ironed down the mat very well. There were no "setting" problems encountered with any of the three asphalts used on the project.

FIELD AND LABORATORY TEST RESULTS

Water permeability tests were performed on the three test sections twenty-four hours after completion of paving and the average results are shown below.

Asphalt Test Section	Permeability Results 24 Hrs. after Paving, Mls/Min
Experimental Shell Asphalt	286 Mls.
Experimental Union Asphalt (with pneumatic)	273 Mls.
Experimental Union Asphalt (without pneumatic)	388 Mls.
Control 85-100 Grade Asphalt	310 Mls.

The permeability results for the test sections were all above the 150 mls/min. tentative maximum requirement for measurements after 24 hours. It seems significant that the experimental Union asphalt test section without pneumatic rolling has much higher permeability results than the section with pneumatic rolling.

Asphalt concrete mix samples were obtained out of the windrow on the grade and the normal routine tests were performed. Abson Recoveries were also performed and various tests were made on the recovered asphalt. The average test results are shown in the tables below and on the following page.

	Average Paving Mixture Test Results								
Asphalt Tested	Stab.	Cohesion	Asphalt Content	Grading 3/4"	3/8"	#4	#8	#30	#200
Experimental Shell	45	444	5.2	99	75	55	41	22	6
Experimental Union	46	451	5.0	97	73	54	40	22	6
Control 85-100 Grade	46	455	4.9	99	73	53	40	22	6

Average Recovered Asphalt Properties						
Asphalt Tested	Street Sample Temps.	Pen. at 77°F	S.P. °F	Duct. 77°F 5 cm/min	Viscosity 140°F Poises	Viscosity 275°F Centistokes
Experimental Shell	278°F	41	127°F	100+CM	6062.7	562
Experimental Union	278°F	45	129°F	100+CM	6079.9	614
Control 85-100 Grade	279°F	45	130°F	100+CM	7901.3	675

Four inch diameter cores were removed from each test section shortly after construction and laboratory tests were performed. The average laboratory tests results on these cores are shown below.

Average Laboratory Test Results on 4" Cores					
Asphalt Tested	Air Permeability Mls/Min	Waxed S. G. Surface Course	Waxed S. G. Base Course	% Air Voids Surface Course	% Air Voids Base Course
Experimental Shell	99	2.37	2.30	7.0	9.8
Experimental Union (Without pneumatic)	-	2.39	2.34	6.3	8.2
Experimental Union (With pneumatic)	25	2.38	2.28	6.6	10.6
Control 85-100 Grade	75	2.30	2.35	9.8	7.8

The test properties of the experimental and control asphalts are compared with the 1965 Tentative Specifications below. The Shell 85-100 grade (control asphalt) was manufactured to comply with the 1964 Standard Specifications.

Asphalt Test	Specification Requirement	Experimental Shell Asphalt	Experimental Union Asphalt	Shell 85-100 Grade Control Asphalt
Flash Point, P.M.C.T. ^{o}F Min.	450	460	455	440
Penetration of Original Sample at 77^{o}F		68	78	88
Stain Number of Original Sample. Maximum after 120 hrs, -140^{o}F-50 psi Pressure	10	5	6	5.5
Rolling Thin Film Test at 325^{o}F-75 Min.				
Viscosity of Residue 140^{o}F Poises	4000 - 6000	4316.4	4486.7	4602.5
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Ductility of Residue 77^{o}F, Min.	75cm	100+cm	100+cm	100+cm
Durability Test				
Viscosity of Residue after durability test, megapoises at 77^{o}F				
Shear Rate 0.05 sec^{-1} Max.	25	33.8*	23.8	34.2
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